# HEAT TREATMENT APPARATUS WITH TEMPERATURE CONTROL SYSTEM


## Abstract of the Disclosure

A floating substrate reactor allows heat treatment of a series of semiconductor substrates, one by one. The heat treatment occurs while flowing gas suspends a substrate between two heated surfaces of the reactor. The two heated surfaces each have multiple heating zones. The heating zones are heated to desired temperature(s) and a substrate is then loaded into the reactor for heat treatment. Upon loading, the relatively cold substrate absorbs heat and cools the process chamber. A heat spike, which can be varied, is applied to the heating zones to heat the reactor to the desired temperature again. The substrate, however, is unloaded from the reactor before the temperatures of the heating zones have reached the desired temperature. After the heating zones have reached the desired temperature, the next substrate in the series of substrates is loaded into the reactor for heat treatment. The heating rate of each heating zone is independently controlled by two nested control loops in a cascade temperature control configuration, permitting differences in the heating rates of the heating zone to be accounted for, thus allowing a uniform temperature or predetermined gradient to be established across all the heating zones. The intensity of the heat spike is recalculated after the introduction of each substrate, using the heating behavior of the previous heat spike as a calculation input, to more accurately heat the heating zones to the desired temperature. The variability of the heat spike intensity from substrate to substrate also allows the throughput of the heat treatment apparatus to be varied.


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